

Casting Processes

The casting process *involves pouring of liquid material (molten article) into a mold cavity of the desired shape and allowing it to solidify to obtain the final casting*. The flow of molten article into the mold cavity depends on several factors like minimum section thickness of the part, number of corners, non-uniform cross-section of the cast, and so on. Important considerations in casting operations are as follows;

1. The flow of the molten article into the mold cavity.
2. The solidification and cooling of the molten article in the mold.
3. The effect of the type of mold material.

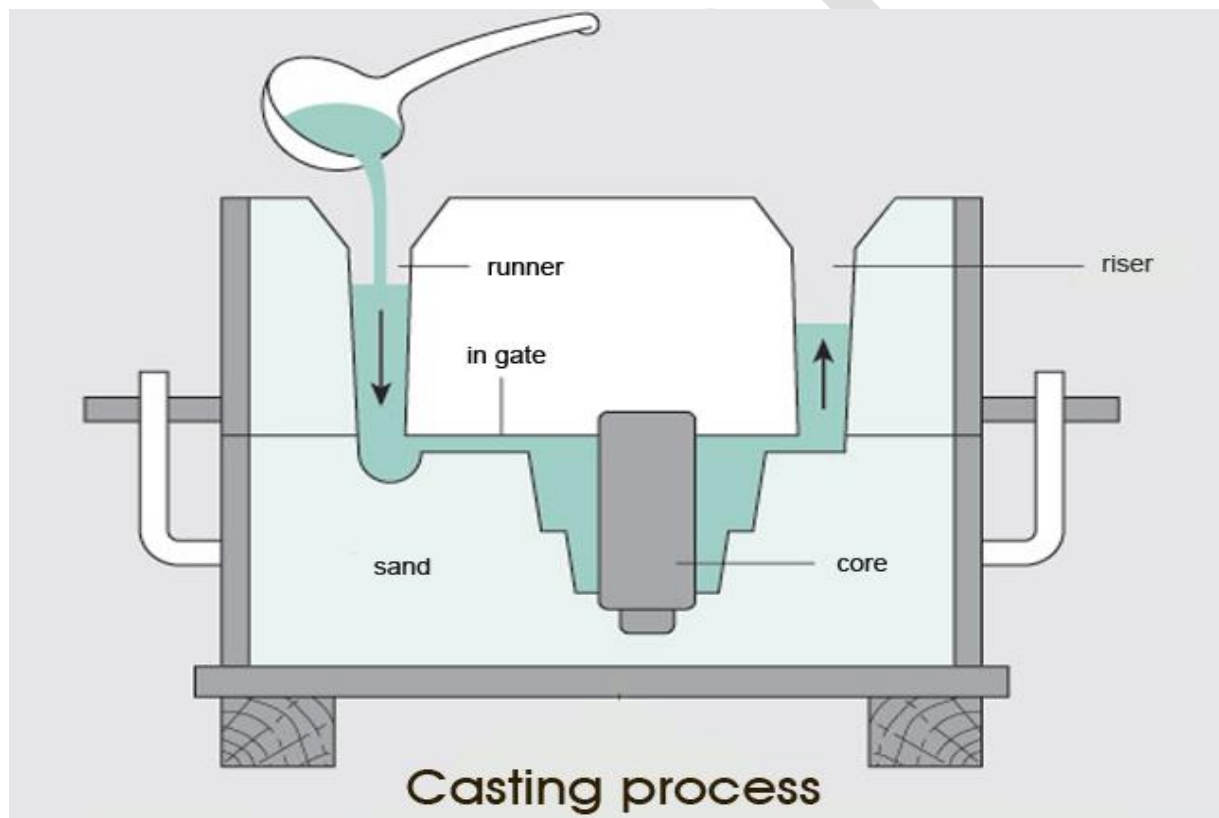


Figure 21 Casting Process

Casting is most often used for making complex shapes that will be difficult or uneconomical to make by other methods. The molten metal is poured into the mold, this mold made of some heat resisting material. Sand is most often used as it resists the high temperature of the molten metal. Permanent molds of metal can also be used to cast products.

Advantages of casting process:

- Molten metal flows into small section in the cavity of mold, hence any complex shape can be easily produced.
- Practically any type of material can be casted.
- Ideal method is by producing small quantities.
- Due to small cooling rate from all directions, the properties of casting are same in all directions.
- Any size of casting can be produced like up to 200 tons.
- Casting is the often cheapest and most direct way of producing a shape with certain desired mechanical properties.
- Certain metals and alloys such as highly creep resistant metal-based alloys for gas turbines cannot be worked mechanically and can be cast only.
- Heavy equipment like machine leads, ship's propeller etc. can be cast easily in the required size rather than fabricating them by joining several small pieces.
- Casting is best suited for composite components requiring different properties in different direction. These are made by incorporating preferable inserts in a casting. For example, aluminium conductors into slots in iron armature for electric motors, wear resistant skins onto shock resistant components.

Limitations of casting process:

- With normal sand casting process, the dimensional accuracies and surface finish is less.
- Defects are unavoidable.
- Sand casting is labor intensive.

Classifications of Casting

The major classifications of casting are according to mold materials, molding processes, and methods of feeding the mold with the molten metal, this classification involves three types are;

1. Expendable mold casting, in this type the molds are made of sand, plaster, ceramics, and similar materials. These are generally mixed with various binders, or bonding agents. These materials are refractories, they are capable of resistance the high temperatures of molten metals. After the casting has solidified, the mold in these processes is broken till remove the product. Expendable mold casting processes are *suitable for very complex shape parts and materials with high melting point temperature*. However, the rate of production is often limited by the time to make mold rather than the casting itself. *The major expendable mold processes are; sand-mold casting, shell- mold casting, expendable-pattern casting, plaster-mold casting, ceramic-mold casting, vacuum casting etc.*

2. Permanent mold casting, the mold is made of metals that maintain their strength at high temperatures. They are used repeating and can be easily removed and the mold used for the next casting. Metal molds are better heat conductors than expendable non- metallic molds, the solidifying casting is subjected to a higher rate of cooling, which effect of the microstructure and grain size of casting. *The permanent-mold casting such as; slash casting, pressure casting, die casting, centrifugal casting, squeeze casting, etc.*

3. Composite mold casting, which are made of two or more different materials, such as sand, graphite, and metal, to combining the advantages of each material. They are used in various casting processes *to improve mold strength, control the cooling rates, and optimize the overall economics of the processes.*